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USE OF THE SCRATCH PLATFORM ALGORITHM: EXPLORING INFORMATION TECHNOLOGIES WITH DIGITAL GAMES

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ABSTRACT
On the global stage, the female presence in technological fields is still disproportionate, making it crucial to develop initiatives that encourage and support the participation of girls in this sector. The Scratch platform, a visual programming tool designed for beginners, provides an ideal opportunity to promote this inclusivity. This work aimed to develop digital games with female participation in information technologies through the creation of digital games at Scratch, promoting the development of programming skills and the exploration of careers in science and technology. The methodology adopted involved the application of technologies to support the construction of knowledge, which puts technology at the service of learners and allows reflection on the learning process. Principles of project pedagogy were applied, enabling students to learn in a practical way and recognize their authorship in the productions. The research resulted in three educational games focused on positive and negative numbers, achieving their goals by improving the technological skills of the students. However, the lack of support for collaborative work on the Scratch platform has presented significant limitations, such as the need to concentrate development on a single account, which has complicated the division of tasks and access to work.

Keywords: Technology. Female. Programming. Digital.

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INTRODUCTION

The advancement of Information and Communication Technologies (ICT) has transformed the way we interact with the world and, simultaneously, shaped the future of science and education. In the context of this panorama, the use of programming platforms such as *Scratch* stands out not only as an educational tool, but also as a means of promoting gender equality and inspiring female protagonism in science. The work aims to explore the intersection between female empowerment and technological education, using digital games as a strategy to engage girls and young women in programming and computer sciences.

The area of robotics and automation is explored to understand how emerging technologies can be employed to create an inclusive and stimulating educational environment, especially for girls interested in science and technology. At the same time, research on the application of ICT focuses on how digital tools such as *Scratch* can be used to promote technological education, facilitating girls' access and participation in the development of games and other interactive applications.

The object of study is the use of the *Scratch* platform as an educational tool for the development of digital games aimed at inclusion and female empowerment in the area of science and technology. The focus is on analyzing how programming with *Scratch* can inspire and empower girls to get involved in technological and scientific areas.

In this premise, the research problem: How can the use of the Scratch platform for the development of digital games contribute to increasing female participation in science and technology areas, promoting gender equality and female protagonism?

Faced with the question, we have the following hypotheses: (i) The creation of digital games with *Scratch* can increase the interest and confidence of girls in technological areas, leading to greater female participation in activities related to science and technology. (ii) Works that incorporate examples of women scientists and technologists as characters or mentors in games developed with *Scratch* have the potential to inspire and motivate more girls to pursue careers in science. (iii) The inclusion of practical and interactive activities in the teaching of programming, through the *Scratch* platform, can reduce the barriers perceived by girls and young women, facilitating their access and engagement with technology.

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The objective is to develop on the *Scratch* platform the creation of digital games to promote female participation in information technologies, encouraging the development of programming skills and the exploration of careers in the area of science and technology.

THEORETICAL FRAMEWORK

SCRATCH TECHNOLOGY IN BLOCK PROGRAMMING

In the global scenario where the female presence in technological fields is still disproportionate, initiatives that encourage and support the participation of girls in this sector are of paramount importance. The inclusion of girls in technological disciplines not only contributes to greater diversity and innovation in the field, but also helps to build a strong foundation for the future development of critical and creative skills. The *Scratch* platform, a visual programming tool designed for beginners, is ideal for this purpose. Its intuitive *design*, which uses blocks of code that can be dragged and combined, makes it easy to learn programming concepts without the need for prior knowledge of complex syntax. This allows participants to focus on the logic and creativity involved in building digital games and animations.

The choice of digital games as a means to explore Information Technologies is particularly relevant. Games are a powerful tool for engaging students, allowing them to apply concepts in a practical and fun way. In addition, creating games allows the development of skills such as problem-solving, critical thinking, and teamwork, essential competencies in both academic and professional life.

The current context demonstrates a growing need for education reforms that integrate technologies and promote inclusion. Esplendor *et al.* (2024) highlight the importance of adopting educational methodologies that prepare students for a world where information and knowledge are crucial. Education must go beyond the simple use of technologies, preparing students to learn continuously and adaptively, which is especially relevant in a rapidly evolving field like programming.

Given that logical reasoning and the ability to solve problems are increasingly valued skills, initiatives that teach these skills from an early age are essential. *Scratch* provides a platform where these skills can be developed in an accessible and engaging way. By involving girls in the creation of digital games, research not only fosters interest in technology but also provides a hands-on experience that can boost participants' confidence and enthusiasm for science and technology (Blikstein, 2016).

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Therefore, the girls with use of the Scratch platform algorithm aims not only to empower young women with fundamental technological skills, but also to contribute to greater gender equity in the field of science and technology.

INFORMATION TECHNOLOGY IN THE LANGUAGE OF SCRATCH

Information and communication play crucial roles in the political, economic, and social transformation we are currently experiencing. In this context, it is essential to reassess and update school curricula and programs so that formal education effectively contributes to the development of the necessary cognitive, social and professional skills (Gatti, 2000).

Costa *et al.* (2012) emphasize that recognizing the transformative potential of ICT is essential to restructure school curricula and programs, promoting the development of the desired skills (Valente, 2005). Among these skills, logical reasoning and the ability to solve problems are fundamental for several areas of knowledge (Zaharija; Mladenovic; Boljat, 2013; Nunes, 2011).

In the field of computing, these professionals often apply an analytical approach to solve problems, developing solutions in the form of algorithms (Easterbrook, 2014). This type of structured thinking, known as computational thinking, was described by Wing (2006), involves: i) problem formulation; ii) analysis and logical organization of data; iii) abstraction for data representation; iv) automation of solutions through algorithms; v) identification and implementation of solutions; and vi) generalization and application of solutions to new problems. Wing (2006) argues that computational thinking can be one of the greatest contributions of computer science and should be taught in several disciplines.

Or *Scratch*, an online programming language, was created to allow beginners to develop programs without the need to learn a complex syntax. The goal is to make learning programming more accessible and fun, through the creation of projects such as interactive animations and digital games (Maloney *et al.*, 2010). According to Zaharija, Mladenovic and Boljat (2013), the *Scratch* encourages children and young people to think creatively, systematically and collaboratively. Its graphical interface and the blocks of colored and categorized commands, such as movement and loops, make it possible to build programs without requiring the memorization of programming codes. The code blocks are dragged and docked in a window to create the program, making the programming process easier.

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METHODOLOGICAL PATH

This work focused on methodologies that use technology to support the construction and understanding of knowledge. The approach adopted involved methods that put technology at the service of learners (Papert, 1986), facilitating their involvement in the planning and creation of a meaningful product, promoting reflection on the learning process (Valente, 2012). Principles of project pedagogy were applied, allowing students to learn in a practical way and recognize their own authorship in the productions, exploring contextual concepts and discovering new ideas during the development of the project (Prado, 2003).

According to Prado (2003), this type of learning favors the development of interpersonal skills, such as selection of relevant information, decision-making, teamwork and management of conflicts of ideas to promote collaborative learning. Based on this methodology, the survey was applied to adolescents in the semesters of 2023 (second semester) and 2024 (first semester). The proposal included face-to-face activities that encouraged colleagues to share and implement ideas through *Scratch*, an interactive and accessible programming environment.

The goal was to provide female students with the necessary resources to acquire knowledge in computing and technological innovation, encouraging them to consider a career in the exact sciences. Four students and a teacher from the 2nd year of high school at a state public school in the city of Quixeramobim participated in the research. To understand the profile of the participants, a questionnaire was applied that investigated access to available technologies, the uses of these technologies in daily life and contact with programming languages.

The plan of activities, divided into three phases – (i) exploration of *Scratch* resources; (ii) planning, development and evaluation of an educational game project; and (iii) preparation of the final report, which was discussed and approved by all those involved. The work was developed over twelve months, between May 2023 and April 2024, as illustrated in Figure 1, which presents the activities carried out during this period.

The research included a total of fifteen meetings, with two weekly meetings, each lasting 2 hours, held in the school's computer labs.

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Figure 1 – Timeline of scheduled activities for 2023-2024

Source: Elaboration by the authors (2024).

Of the four students involved, aged between 14 and 16 years. All participants use technologies in their daily lives, and most (2 students) learned to handle the computer in a self-taught way. School, teacher and friends do not play a significant role in this learning process for this group. None of the students has technical training in computer science or related areas. In terms of the use of digital technologies, the preference of female students falls on mobile devices such as *Smartphones* and *Tablets*, which offer mobility and connectivity, in contrast to less portable technologies such as computers *desktop* and cameras.

ANALYSIS AND DISCUSSION OF THE RESULTS

The research was developed with three educational games, addressing situations with the use of positive and negative numbers and challenging players to solve the count.

In the digital balloon game, the central objective is to accumulate as many points as possible by popping balloons that appear on the screen. Each popped balloon rewards the player with points, and the ability to click or tap on them quickly is key to maximizing the score. However, the game also penalizes the player for not popping balloons, resulting in a loss of points. Balloons that are not popped can accumulate and eventually cause additional failures or penalties if not dealt with in time. Thus, the balance between popping the balloons correctly and avoiding the accumulation of unpopped balloons is important for success in the game.

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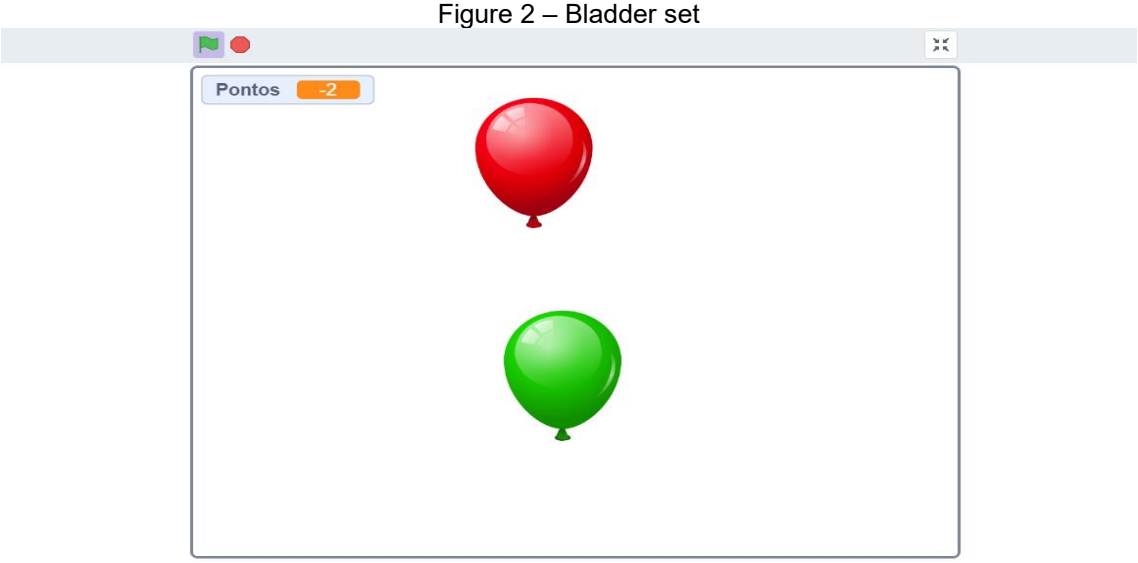
Figure 2 – Bladder set



Source: Elaboration by the authors (2024).

The digital bar game is a captivating game where the player controls a small bar, a character usually represented by a simple shape or an animated icon. The main objective of the game is to accumulate points, which are earned by performing specific tasks, such as collecting items. However, the difficulty is increased by the presence of a spider, which poses a constant danger. The spider moves around the environment, and the player must avoid its contact so as not to lose lives or points. The game requires agility and strategy, as the player must move carefully to avoid the spider while trying to maximize collecting points. The combination of challenges and rewards makes the game exciting and engaging, requiring the player to maintain attention and skill to achieve the best possible scores without getting caught by the spider threat.

Figure 3 – Stressed cockroach

Source: Elaboration by the authors (2024).

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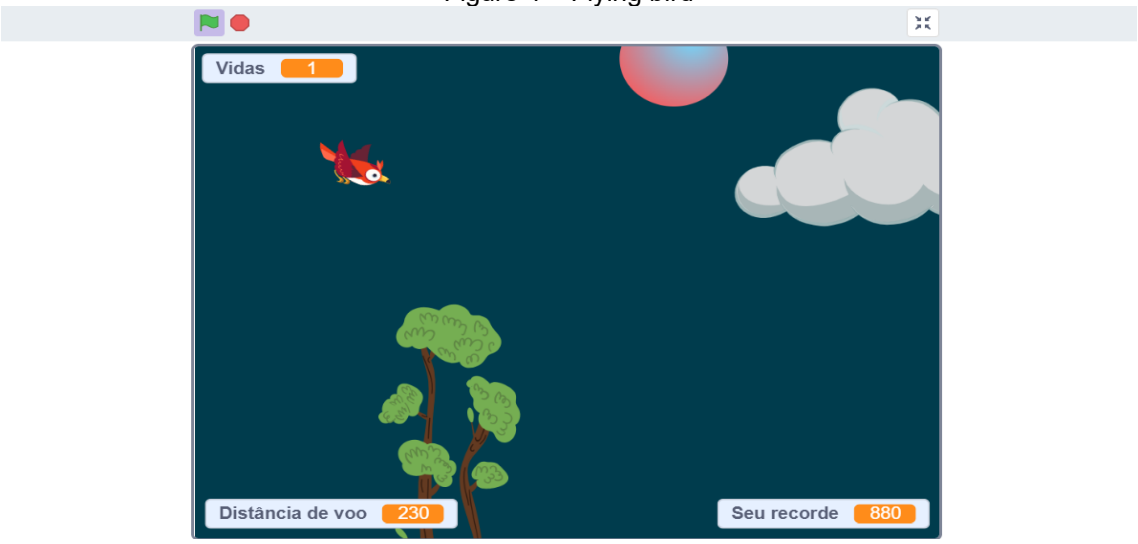
The flying bird game is a challenging and engaging digital game where the player controls a bird that must fly through a scenario full of obstacles. The main objective is to keep the bird in continuous flight without colliding with any objects, such as barriers or obstacles that appear along the way. Each collision results in the death of the bird and, consequently, the end of the game or the loss of a life. The game requires quick reflexes and coordination skills, as the player needs to constantly adjust the bird's altitude and trajectory to avoid obstacles and keep moving forward. The difficulty increases as the game progresses, with obstacles becoming more frequent and challenging. The score is usually based on the distance traveled or the number of obstacles avoided, encouraging the player to improve their performance and reach new marks. The simplicity of the concept, combined with the increasing difficulty, makes the flying bird game an exciting and addictive experience.

Figure 4 – Flying bird



Source: Elaboration by the authors (2024).

The main objective of the work was to introduce fundamental concepts of the algorithm of the *Scratch* to four second-year high school students from a public school. In addition, as part of the project it aimed to offer an enriching academic experience, with an emphasis on scientific research. To achieve these objectives, methodologies based on project pedagogy were employed, facilitating the conduction of theoretical and practical activities that promoted the understanding and application of the block fitting algorithm, in addition to developing interpersonal and research skills.

The exploitation of the resources of the *Scratch* It allowed to stimulate logical reasoning and counting resolution in a playful and engaging way, in addition to providing an

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initial foundation in programming. During the planning, creation and evaluation phases of the educational games, three concrete works were generated that showed how the students applied skills of organization and analysis of information, as well as the appropriation of the concepts of the algorithm by blocks; The collaborative development activities of the games also encouraged conflict resolution and decision-making as a team to achieve common goals.

The final report of the activities served as an important tool for reflection and synthesis, even with the students' difficulties in expressing their experiences in writing. Testimonies such as that of a student, who commented on the understanding of the dynamics of the games and the critical analysis of how they are programmed, confirm the effectiveness of the research. The experience also revealed that the students obtained an accessible reality and that the commitment to their studies can open doors to higher education, as evidenced in the reports of satisfaction, such as that of a student who valued the opportunity to be in a job with the use of digital technology.

Additionally, a significant indirect effect was the presentation of the games created by the students at school. This action helped to bring the school closer to the local community, increasing awareness and interest among teachers and students about participating in future projects.

FINAL CONSIDERATIONS

The work had its objectives achieved, it is essential to consider the limitations and opportunities for expansion of the work carried out. In the use of the *Scratch* platform for the creation of digital games, a significant limitation was observed: the lack of support for collaborative work. As *Scratch* does not allow several users to share the same workspace simultaneously, the students had to concentrate the development of the projects on the account of a single member of the group. This led to challenges around the division of tasks and continued access to work when the account owner was unavailable.

In addition, regarding the planning of the games, it would be beneficial to provide more detailed guidance on the different possibilities that the *Scratch* offers for creating games.

Finally, it is crucial to highlight that, although the initiatives of the work may serve a limited number of students, they play a vital role in stimulating school interest and strengthening the bond between the community and local schools. The research offered the

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four participating students the opportunity to enrich their personal and school education, as well as prepare them for future academic and professional challenges.

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